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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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FAY, SHARPE, FAGAN, MINNICH & MCKEE, LLP 1100 SUPERIOR AVENUE, SEVENTH FLOOR CLEVELAND, OH 44114			EXAMINER PATEL, ISHWARBHAI B	
			ART UNIT	PAPER NUMBER
			2841	

DATE MAILED: 11/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/063,104

Applicant(s)

BECKER ET AL.

Examiner

Ishwar (I. B.) Patel

Art Unit

2841

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 September 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-59 is/are pending in the application.
- 4a) Of the above claim(s) 14-59 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 September 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This action is in response to the amendment filed on September 1, 2006.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-7, 12 and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Eichelberger, US Patent No. 5,452,182.

Regarding claim 1, Eichelberger, in figure 1, discloses a flexible interconnect structure comprising: a first flexible dielectric film (32) having two opposed surfaces (upper and lower surfaces), at least a portion of said dielectric film being removed (dielectric film removed for the via holes, column 8, line 12-16) through a thickness thereof, forming at least a removed portion (via holes); circuit traces (35) disposed on at least one of said surfaces (column 8, line 12-13), and a plurality of heat sink (14) coupled to said dielectric film, each of said plurality of heat sink covering a corresponding one of a removed portions (covering the area around the via hole, see figure 1) and less than an entire surface of said flexible dielectric film (covering only part

of the film 32, see figure 1), such that the interconnect structure remains flexible (structure is flexible as shown in figure 1).

Regarding claim 2, Eichelberger further discloses said dielectric film comprises a flexible material that provides isolation across a thickness of said dielectric film, said material being polyimide (column 7, line 57-64).

Regarding claim 3, Eichelberger further discloses said dielectric film with a thickness in a range from 12.5 to 75 micrometer, which is within the claimed range 1 micrometer to about 5 mm (column 2, line 20-25, which is disclosed by reference, column 10, line 29-45).

Regarding claim 4, Eichelberger further discloses one electrical component, integrated circuits (20).

Regarding claim 5, Eichelberger further discloses a dielectric protective layer disposed to cover said circuit traces (layer 36) and electrical circuits (column 2, line 9-12).

Regarding claim 6, Eichelberger further discloses said plurality of heat sink each comprises a thermally conductive material (14, made of Alumina or another electrically insulating thermally conducting material, column 7, line 54-56).

Regarding claim 7, Eichelberger further discloses said thermally conductive material is ceramic (14, made of Alumina or another electrically insulating thermally conducting material, column 7, line 54-56).

Regarding claim 12, Eichelberger further discloses said at least one of said heat sinks covers a plurality of said removed portions (heat sink covering via holes, only one shown in the figure, column 8, line 12-20).

Regarding claim 13, Eichelberger further discloses said at least one of said heat sinks comprises a body made of ceramics (14, made of Alumina or another electrically insulating thermally conducting material, column 7, line 54-56).

4. Claims 1 are rejected under 35 U.S.C. 102(e) as being anticipated by Yen (US Patent No. 6,612,717).

Regarding claim 1, Yen, in figure 4-6, discloses a flexible interconnect structure comprising: a flexible dielectric film (soft circuit including circuit board 312, column 2, line 50-53) having two opposed surfaces, at least a portion of said dielectric film being removed through a thickness thereof forming a plurality of removed portions (the portion of the board removed as the LEDs 11 are installed in the circuit board); circuit traces (traces on the board for connection, not specifically shown in the figure) disposed on at least one of said opposing surfaces, and a plurality of heat sinks (313) coupled to a

surface of said dielectric film, each of said plurality of heat sink covering corresponding one of a plurality of removed portions (see figure 4 and 5) and less than one of said opposing surface of said flexible dielectric film (the heat sink is only on one side, see figure), such that the interconnect structure remains flexible (the interconnect structure remain flexible, see figure 6).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eichelberger as applied to claim 1 above, and further in view of Azar, US Patent No. 5,920,458.

Regarding claim 8, Eichelberger discloses all the features of the claimed invention as applied to claim 1 above, including the heat sink, but fails to disclose heat sink with fins.

Azar, in embodiment shown in figure 4, discloses a printed circuit board assembly with an enhance cooling of a heat dissipating circuit element, with a heat sink having fins (32, figure 4) for enhancing the heat dissipation.

A person of ordinary skill at the time of applicant's claims invention would have recognized the advantage of providing fins to the heat sink in order to enhance the heat dissipation rate.

Therefore, it would have been obvious to a person of ordinary skill in the at the time of applicant's invention to provide the assembly of Eichelberger with the heat sink having fins, as taught by Azar, in order to enhance the heat dissipation rate.

Regarding claim 9-11 discloses all the features of the claimed invention as applied to claim 1 above, including the heat sink, but fails to disclose said heat sink comprise heat pipes to carry heat away from an electrical component disposed thereon, as claimed in claim 9, said heat sink comprises a mechanism for active cooling, as claimed in claim 10 and said active cooling is effected by a mechanism selected from forced cooling or refrigeration, as claimed in claim 11.

Azar, in another embodiment (figure 5), further discloses the heat dissipation member comprises a hollow core heat exchanger 36. A flow controller 38, which may be refrigerator-type device, in fluid communication with a through bore 39 of the heat exchanger 36. Either liquid or air can be utilized as a coolant and the flow controller 38 effects the passage of such coolant through the through bore 39 of the heat exchanger 36, column 3, line 35-43, for further enhancing the heat dissipation rate.

A person of ordinary skill at the time of applicant's claims invention would have recognized the advantage of providing such elements to enhance the heat dissipation rate.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of applicant's invention to provide the assembly of Eichelberger et al., with said heat sink comprising heat pipes to carry heat away from an electrical component disposed thereon, as claimed in claim 9, said heat sink comprising a mechanism for active cooling, as claimed in claim 10 and said active cooling is effected by a mechanism selected from forced cooling or refrigeration, as claimed in claim 11, as taught by Azar, in order to enhance the heat dissipation rate.

7. Claims 1, 2, 4, 6, 7, 8, 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bechl (US Patent No. 6,299,337) as in view of Hochstein (US Patent No. 6,517,218).

Regarding claim 1, Bechl, in figure 1, discloses a flexible interconnect structure comprising: a flexible dielectric film (2) having two opposed surfaces, circuit traces (traces where element LEDs 30 and resistors 31 are connected, not shown in detail in the figure) disposed on at least one of said opposing surfaces, and a plurality of heat sinks (2) coupled to a surface of said dielectric film.

Bechl does not specifically disclose at least a portion of said dielectric film being removed through a thickness thereof forming a plurality of removed portions; each of said plurality of heat sink covering corresponding one of a plurality of removed portions and less than one of said opposing surface of said flexible dielectric film (), such that the interconnect structure remains flexible. Though, Bechl not disclose the detail of the connection of the LEDs (30) with the flexible film and that with the heat sink, it is old and

know in the art to provide a removed portion (a hole) in the flexible film to directly connect the each LEDs with the heat sink to facilitate better heat removal rate.

Hochstein, in figure 2 and 3, discloses a structure with a hole in dielectric film (32) to have a direct connection of the LED (12) with the heat sink.

Therefore, it would have been obvious to provide the structure of Bechl with a hole in the flexible film (2), as taught by Hochstein, in order to a direct contact of the heat sink with the LEDs. This structure also meets the limitations "each of said plurality of heat sink covering corresponding one of a plurality of removed portions and less than one of said opposing surface of said flexible dielectric film, such that the interconnect structure remains flexible" as the heat sink (2) will cover corresponding one of plurality of removed portions and structure is flexible as shown in figure 1.

Regarding claim 2, the modified board of Bechl further discloses said dielectric film made of polyimide (column 2, line 34-47).

Regarding claim 4, the modified board of Bechl further discloses further discloses an integrated circuit (LED die, Hochstein element 12) as an electrical circuit component.

Regarding claim 6 and 7, the modified board of Bechl further discloses said plurality of heat sinks each comprise a thermally conductive material selected from metal (made of aluminum, column 3, line 30-35).

Regarding claim 8, the modified board of Bechl further discloses said at least one of said heat sinks has fins extending away from said dielectric film.

Regarding claim 12, the modified board of Bechl further discloses said at least one of said heat sinks cover plurality of removed portions as applied to claims 1 above, as each heat sink is covering more than one LEDs).

Regarding claim 13, the modified board of Bechl further discloses said plurality of heat sinks comprises a body made of metal (made of aluminum, column 3, line 30-35).

8. Claims 9 -10 are rejected under 35 U.S.C. 103(a) as being unpatentable over the modified board of Bechl as applied to claim 1 above, and further in view of Azar, US Patent No. 5,920,458.

Regarding claim 9-11, the modified board of Bechl discloses all the features of the claimed invention including the heat sink, but does not disclose said heat sink comprise heat pipes to carry heat away from an electrical component disposed thereon, as claimed in claim 9, said heat sink comprises a mechanism for active cooling, as claimed in claim 10 and said active cooling is effected by a mechanism selected from forced cooling or refrigeration, as claimed in claim 11.

Azar, in embodiment of figure 5 discloses the heat dissipation member comprises a hollow core heat exchanger 36. A flow controller 38, which may be refrigerator-type device, in fluid communication with a through bore 39 of the heat exchanger 36. Either liquid or air can be utilized as a coolant and the flow controller 38 effects the passage of such coolant through the through bore 39 of the heat exchanger 36, column 3, line 35-43, for further enhancing the heat dissipation rate.

A person of ordinary skill at the time of applicant's claims invention would have recognized the advantage of providing such elements to enhance the heat dissipation rate.

Therefore, it would have been obvious to a person of ordinary skill in the at the time of applicant's invention to provide the modified assembly of Bechl with said heat sink comprising heat pipes to carry heat away from an electrical component disposed thereon, as claimed in claim 9, said heat sink comprising a mechanism for active cooling, as claimed in claim 10 and said active cooling is effected by a mechanism selected from forced cooling or refrigeration, as claimed in claim 11, as taught by Azar, in order to in order to enhance the heat dissipation rate.

9. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over the modified board of Bechl as applied to claim 1 above, and further in view of Kirby (US Patent No. 4,563,725).

Regarding claim 3, the modified board of Bechl discloses all the features of the claimed invention including the dielectric film, but does not explicitly disclose the

thickness of the film in a range from about 1 micrometer to about 5 mm. However, the thickness will be selected based on the required flexibility of the board.

Kirby in figure 1 discloses a substrate (1) with a thickness of about 0.5 mm, which is within the range from about 1 micrometer to about 5 mm, (column 6, line 30-35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of applicant's invention to provide the modified board of Bechl the film having thickness in a range from about 1 micrometer to about 5 mm, as taught by Kirby, in order to have desired flexibility.

Further, it has been held to that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

10. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over the modified board of Bechl as applied to claim 1 above, and further in view of Haley, US Patent No. 5,506,756 and Pastore et al., US Patent No. 5,285,352.

Regarding claim 5, the modified board of Bechl discloses all the features of the claimed invention including the electrical component and the circuit traces as applied to claim 1 above but does not disclose a dielectric protective layer disposed to cover said electrical circuit component and circuit traces.

Haley discloses a package with an integrated circuit mounted on the flexible circuit board with a housing, preferably injection molded plastic material covering the

integrated circuit and the traces, providing enough stiffness to structurally support the component and the circuit board, column 2, line 40-45 and column 3, line 43-46, figure 1 and 5.

Pastore et al., discloses a semiconductor device with the die and portion of the substrate encapsulated in a conventional epoxy resin package.

As disclosed by Haley and Pastore, it is known in the art to provide a protective cover to the component and the substrate to encapsulate for protection against environmental and other damage and to provide necessary stiffness.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of applicant's invention to provide the modified assembly of Bechl with a protective layer, from the teachings of Haley and Pastore, in order to encapsulate the component and the substrate to have a protection against environmental and other damage and to provide necessary stiffness to the assembly.

Response to Arguments

11. Applicant's arguments with respect to claims 1-13 have been considered but are moot in view of the new ground(s) of rejection.

Further, applicant's argument regarding the claim rejection with the prior art of Eichelberger are reviewed carefully but not found to be persuasive. Applicant, on page 15 or the response filed on September 29, 2005 argues that Eichelberger does not disclose a plurality of heat sinks coupled to a surface of said dielectric film, where each of the plurality of the plurality of heat sinks covers a corresponding one of a plurality of

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removed portion. However, as shown in figure, Eichelberger clearly shown a corresponding one of removed portion covered by the heat sink. Covering multiple via does not exclude covering corresponding one of removed portions covered by the heat sink. Applicant further argues that the structure of Eichelberger does not remain flexible. This is not found to be persuasive. As can be seen in figure 1, the structure is bent. It is to be pointed out the substrate is (30) which is flexible. The heat sink individually may not be flexible.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ishwar (I. B.) Patel whose telephone number is (571) 272 1933. The examiner can normally be reached on M-F (8:30 - 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dean Reichard can be reached on (571) 272 1984. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ibp
November 12, 2006


Ishwar (I. B.) Patel
Primary Examiner